CLAIMS

I claim:

1. An optical coupler, comprising:

a substrate;

a diffractive optical element defined in the substrate, the diffractive optical element structured to receive incident light diverging from a first location and to focus the incident light at a second location opposite the first location;

an electro-optical device mounted on the substrate to one of (a) emit light from and (b) receive light at one of the locations; and

an optical waveguide mounted on the substrate to one of (a) receive light at and (b) emit light from the other of the locations.

2. The optical coupler of claim 1, in which the electro-optical device comprises one of a laser, a light emitting diode and a photodetector.

3. The optical coupler of claim 1, in which:

the diffractive optical element defines a plane; and

the electro-optical device has a device optical axis and is mounted with the device optical axis tilted with respect to the plane.

4. The optical coupler of claim 3, additionally comprising a pedestal defined in the substrate and supporting at least a portion of the electro-optical device.

5. The optical coupler of claim 1, in which:

the diffractive optical element defines a plane; and

the optical waveguide has a waveguide optical axis and is mounted with the waveguide optical axis tilted with respect to the plane.

6. The optical coupler of claim 5, additionally comprising a pedestal defined in the substrate and supporting at least a portion of the optical waveguide.

7. The optical coupler of claim 1, in which the substrate defines a channel aligned with the diffractive optical element and structured to receive the optical waveguide.

8. The optical coupler of claim 1, in which:

the diffractive optical element defines a plane;

the electro-optical device has a device optical axis and is mounted with the device optical axis parallel to the plane; and

the optical waveguide has a waveguide optical axis and is mounted with the waveguide optical axis parallel to the device optical axis.

9. The optical coupler of claim 1, in which the diffractive optical element comprises one of a concentric blazed grating and a vortex diffractive optical element.

10. The optical coupler of claim 1, in which the diffractive optical element comprises a concentric grating pattern superposed with a radial grating pattern.

11. The optical coupler of claim 1, additionally comprising one of a micro-prism and a micro-diffractive element located between the electro-optical device and the diffractive optical element.

12. The optical coupler of claim 1, additionally comprising one of a micro-prism and a micro-diffractive element located between the optical waveguide and the diffractive optical element.

13. The optical coupler of claim 1, in which:

the first location and the second location define a line parallel to and offset from a plane defined by the diffractive optical element.

14. An optical coupling method, comprising:

providing a diffractive optical element;

obliquely illuminating the diffractive optical element with incident light;

focusing the incident light with the diffractive optical element; and

receiving the focused, diffracted light.

15. A method of manufacturing an optical coupling, comprising:

providing a substrate comprising a semiconductor layer;

forming in the semiconductor layer an electro-optical device having a front facet;

etching the substrate to form a recessed surface adjacent the front facet; and

defining a diffractive optical element in the recessed surface.

16. The method of claim 15, additionally comprising positioning an optical waveguide on the substrate across the diffractive optical element from the front facet.

17. The method of claim 15, additionally comprising:

etching a channel in the substrate across the diffractive optical element from the front facet; and

positioning an optical waveguide in the channel.

18. The method of claim 15, additionally comprising etching the substrate to define a pedestal.

19. The method of claim 18, in which:

the pedestal is across the diffractive optical element from the front facet; and

the method additionally comprises supporting an optical waveguide with the pedestal, the optical waveguide tilted toward the diffractive optical element.

20. The method of claim 15, additionally comprising mounting an optical element adjacent the front facet, the optical element comprising one of a micro-prism and a micro-diffractive element.